

ECONOMIC ASSESSMENT OF MUSTARD AND GROUNDNUT PRODUCTION IN SELECTED AREAS OF BANGLADESH

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Abstract

A study was conducted to perform the economic analysis of mustard and groundnut production in selected 90 mustard farmers from Rajshahi, Pabna, Sirajgonj districts and 35 groundnut farmers from Mymensingh district for interview. Forty nine percent of the total sampled areas were covered by mustard and 35.78% by groundnut of which 40 and 10.26 % were covered by HYV mustard and groundnut, respectively. The cost of HYV and local variety of mustard were Tk. 34060/ha and Tk. 28181/ha and net return of Tk. 27814/ha and Tk. 8914/ha. The cost of HYV and local variety of groundnut were Tk. 57749/ha and Tk. 43062/ha, respectively with net return of Tk. 21635/ha and Tk. 10116/ha. The benefit cost ratio of HYV mustard and groundnut were 1.82 and 1.37 over total cost basis and 2.63 and 1.98 over variable cost basis, respectively. Functional analysis showed that human labour, urea and TSP had significant impact on HYV mustard cultivation whereas human labour, TSP and gypsum was not significant for groundnut production. Scarcity of fertilizer was a major problem faced by the mustard and groundnut farmers in the study areas.

Introduction

Bangladesh is an agricultural country where different kinds of crops like cereals, pulses, oilseeds, vegetables and fruits are grown. Presently the requirement of country's edible oil is about 1.4 million metric tones of which a maximum of about 0.55 million metric tones is being supplied from the internal oilseeds production. This huge shortage is met through importing, which amount to about 76,729 million taka (Bakr, 2009). Groundnut contains vegetable oil (45-50%), protein (25-30%), carbohydrate (20%) and vitamin A and E (Ready & Kaul, 1986). It grows well in char land and yields are not much affected by changes in the sowing time. Its yield is much higher compared to other oilseed crops but not at satisfactory level (Farid, 2001). The yield (1491 kg/ha) of BARISarisha variety was developed by BARI showed higher than that of local variety (979 kg/ha). The areas under mustard and groundnut cultivation are 210526 ha and 33665 ha with the production of 189000 tons and 45910 tons, respectively (BBS, 2007). The maximum yield of groundnut was obtained by application of 30:26:33 kg NPK/ha in combination with gypsum application (Prasad, 2002). Sarker (2007) reported that the farmer received Tk.32539/ha and Tk.48131/ha as net return from sole mustard and mustard +garlic (intercrop), respectively.

Considering the ever-increasing demand of edible oils of the country, it is extremely needed to increase the total production of oilcrops by replacing the low yielding varieties by HYVs,

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improving management practices as well as increasing the area of cultivation where-ever possible. To minimize the yield gap between the farmer's field and research station trials, it is essential to undertake intensive research, extension and development activities (Wahhab *et. al* 2002). A number of indigenous low yielding oilseeds, traditionally cultivated in different parts of the country are highly susceptible to diseases and insect pests. Considering these factors, Bangladesh Agricultural Research Institute (BARI) have already developed 15 high yielding mustard varieties and 8 high yielding groundnut varieties along with recommended production packages. Attempts has been made to introduce HYV mustard/rapeseed and groundnut replacing the low yielding local varieties by motivating farmers through training, demonstration trials and publicities. For these purposes production of HYVs quality seed of mustard/rapeseed and groundnut should be ensured by involving different Government and non-government organizations in seed production and distributions. Hence, best possible way to increase production is to increase productivity by increasing efficiency. Considering its economic importance to achieve the sustainable mustard and groundnut production in Bangladesh, this study was under taken with the following objectives - to estimate the growth rate of mustard and groundnut cultivation in Bangladesh, to analyze the adoption level of mustard and groundnut cultivation, to assess the costs and returns of mustard and groundnut production, to analyze the interrelationship between inputs and outputs of mustard and groundnut cultivation and to identify the constraints of mustard and groundnut production.

Materials and Methods

Sampling design and data

The study was undertaken during 2007-2008 in four districts of Bangladesh, namely Rajshahi, Pabna, Sirajgonj and Mymensingh. In each district one upazilla and from each upazilla two villages were purposively selected on the basis of intensive mustard and groundnut growing area. A total of 90 sample farmers for mustard were selected randomly from Rajshahi, Pabna and Sirajgonj districts and 35 groundnut growers were also selected randomly from Mymensingh district. Data were collected with the help of a pre-designed and pre-tested interview schedule. The collected data were summarized and analyzed to fulfill the objectives set for the study. Tabular method of analysis using average, percentage, ratio etc. was done in this study.

Analytical Model

To estimation of growth rate time series data on area, production and yields of mustard and groundnut for 35 years from 1971/72 to 2005/06 were obtained from the website of the Ministry of Agriculture and different issues of the Statistical Yearbook of Bangladesh. The whole period (1972-2006) was divided into four periods viz, Period I (1972-1981), Period II (1982-1991), Period III (1992-2001), and period IV (2002-2006) to compare the rate of changes occurred in the area, production and yield of mustard and groundnut and explore the causes of changes.

The growth rates of area, production of mustard and groundnut were worked out by fitting a semi-log function of the following type:

$$y = e^{a+bt} \text{ or } \ln y = a + bt$$

Where, y = Area (ha) or production (ton), t = Time period (year)

The production of mustard and groundnut is likely to be influenced by different factors. To determine the contribution of some important inputs of growing mustard and groundnut, the Cobb-Douglas production model was estimated because of the best fit of the sample data. The functional form of the Cobb-Douglas multiple regression equation was as follows.

$$Y = aX_1^{b_1} X_2^{b_2} \dots X_n^{b_n} e^{u_i}$$

For the purpose of the present empirical exercise the Cobb-Douglas production function was converted into the following logarithmic (Double log) form with variables:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + \dots + b_8 \ln X_8 + U_i$$

Where,

Y	=	Yield (kg/ha)
X ₁	=	Human Labour (man-day/ha)
X ₂	=	Ploughing cost (Tk/ha)
X ₃	=	Seed (kg/ha)
X ₄	=	Urea (kg/ha)
X ₅	=	TSP (kg/ha)
X ₆	=	MP (kg/ha)
X ₇	=	Gypsum (kg/ha)
X ₈	=	Irrigation and insecticide (Tk/ha)
b ₁ , b ₂ b ₈	=	Coefficient of the respective variable
U _i	=	Error term

Estimation of costs and benefits

The per hectare cost of mustard and groundnut cultivation was calculated by summing up all the costs incurred for various inputs. Gross return per hectare was calculated by summing up the value of output and its byproducts. The prevailing market prices of inputs and outputs were taken into consideration in this report. Net return was estimated by deducting gross cost from gross return.

Results and Discussion

Trend of area and production of mustard and groundnut in Bangladesh

Fig. 1 and 2 represent area and production under mustard and groundnut in Bangladesh. During the period of 1972 to 1983 the area under mustard cultivation was observed little fluctuation and increased upto 1986. After that the area under mustard decreasing than previous three years but it was much higher than initial year. During the period of 1988 to 2000 the area under mustard was more or less remain same. On the other hand, the area under groundnut cultivation was more or less same during the period of 1972 to 1987 and after that increased upto 2000. The area of mustard and groundnut cultivation was decreasing after 2000 (Fig. 1). Same trend was found in case of production of mustard and groundnut (Fig. 2). This may be due to competing with Boro and other rabi crops.

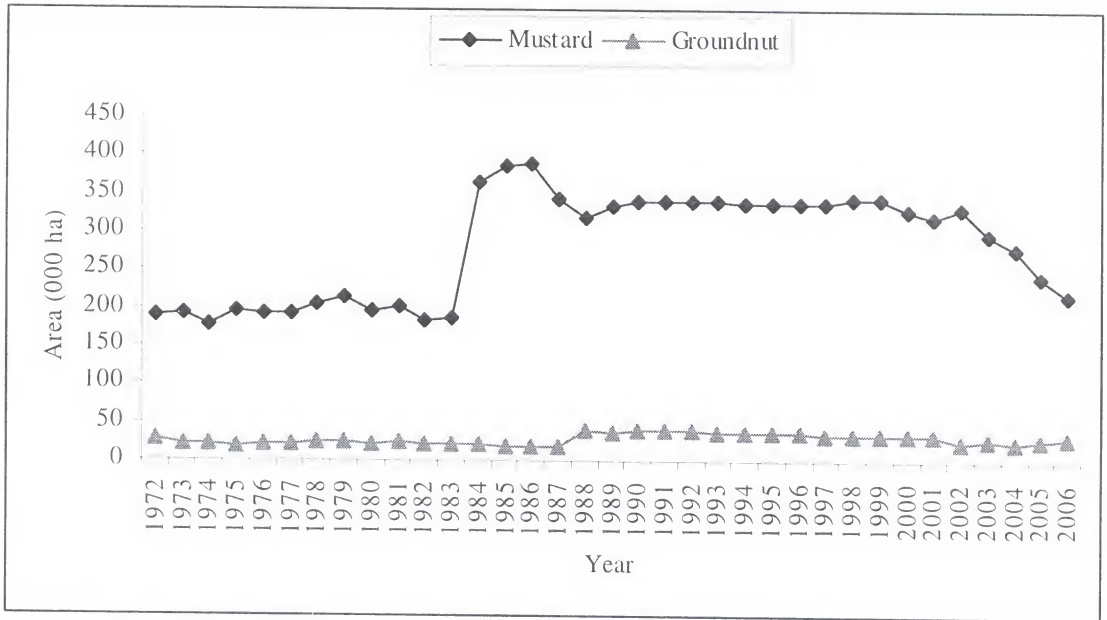


Fig. 1 Trend of area of mustard and groundnut production

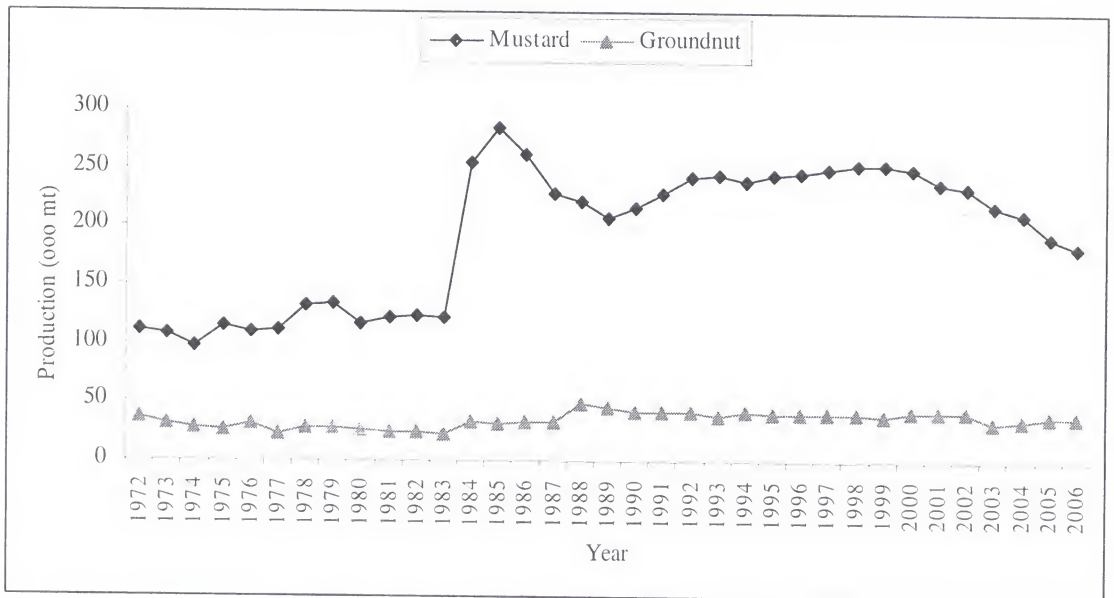


Fig. 2. Trend of production of mustard and groundnut

The area and production of mustard and groundnut registered positive growth rates over the period of 35 years (1972-2006). The overall growth rate of mustard production was found higher than that of groundnut. The growth rates of both the crops mustard and groundnut areas were negative but production rate of mustard and groundnut showed positive during 1992-2001 (Table 1).

Table 1. Growth rates of area and production of mustard and groundnut during 1972-2006

Year	Mustard	Groundnut
	Area	
1972-1981	0.011	0.003
1982-1991	0.052	0.091
1992-2001	-0.004	0.014
2002-2006	-0.105	0.033
1972-2006	0.016	0.014
	Production	
1972-1981	0.020	-0.028
1982-1991	0.046	0.071
1992-2001	0.002	0.0007
2002-2006	-0.061	-0.007
1972-2006	0.025	0.013

Area covered by mustard and groundnut cultivation

In the study areas, 48.78% area covered by mustard in respect with total cultivated sampled areas. Out of this area, 40% covered by HYV mustard and rest by local variety (Table 2 and 3). On the other hand, 35.78% area covered by groundnut in respect with total cultivated sampled areas. Out of which, 10.26% area covered by HYV groundnut and rest by local variety (Table 4 and 5).

Table 2. Average area covered by mustard in the sampled farmer

Locations	Total land (ha/farmer)	Cultivated land (ha/farmer)	Land under mustard cultivation	% in respect with cultivated land
Rajshahi	1.24	1.18	0.46	38.98
Pabna	0.66	0.58	0.29	50
Sirajgonj	0.64	0.71	0.46	64.79
All	0.85	0.82	0.40	48.78

Table 3. Average area covered by HYV and local mustard cultivation in the sampled farmer

Locations	HYV (ha)		Local (ha)	
	Total (ha/farmer)	% in respect with mustard cultivated areas	Total (ha/farmer)	% in respect with mustard cultivated areas
Rajshahi	0.18	39.13	0.28	60.87
Pabna	0.12	41.38	0.17	58.62
Sirajgonj	0.19	41.30	0.27	58.70
All	0.16	40.00	0.24	60.00

Table 4. Average area covered by groundnut in the sampled farmers

Locations	Total land (ha/farmer)	Cultivated land (ha/farmer)	Land under groundnut cultivation	% in respect with cultivated land
Mymensingh	1.26	1.09	0.39	35.78

Table 5. Average area covered by HYV and local groundnut cultivation in the sampled farmers

Locations	Total (ha/farmer)	% in respect with groundnut cultivated areas (HYV) (ha)	Total (ha/farmer)	% in respect with groundnut cultivated areas (local) (ha)
Mymensingh	0.04	10.26	0.35	89.74

Pattern of Input Use

Human labour was mainly employed in land preparation, seed sowing, fertilizer, insecticides, weeding, harvesting and threshing. Table 6 and Table 7 shows that 95 man-days and 140 man-days of human labour were required per hectare in cultivating HYV mustard and groundnut, 73 man-days and 102 man-days for local varieties. The farmers of Rajshahi used more labour for HYV mustard cultivation than that of Pabna and Sirajgonj. On an average, seed rate was used 7.66 and 110.61 kg/ha for HYV mustard and groundnut, respectively, whereas it was 8.02 and 124.75 kg/ha for local varieties. Per hectare fertilizer (urea, TSP, MP and gypsum)

Table 6. Pattern of labour and input use for the cultivation of mustard in sampled area

Labour and Inputs used	Location							
	Local Variety				HYV			
	Raj-shahi	Pabna	Siraj-ganj	All	Raj-shahi	Pabna	Siraj-ganj	All
H. labour (m-d/ha)	78	71	70	73	100	94	90	95
Hired labour	51	42	48	47	67	56	62	62
Family labour	27	29	22	26	33	38	28	33
Seed (kg/ha)	7.52	7.93	8.61	8.02	7.44	7.79	7.74	7.66
Urea (kg/ha)	119.82	144.82	176.20	146.95	173.25	153.74	207.33	178.11
TSP (kg/ha)	34.31	103.26	108.31	81.96	141.16	126.24	146.69	138.03
MP (kg/ha)	34.02	54.00	47.26	45.09	64.54	73.31	73.88	70.58
DAP (kg/ha)	33.64	---	48.78	27.47	3.74	---	---	1.25
Gypsum (kg/ha)	20.16	70.83	48.39	46.46	125.93	117.77	111.69	118.46
Borax (kg/ha)	1.18	1.0	1.26	1.15	3.97	4.53	1.97	3.49
ZnO (kg/ha)	---	0.72	---	0.24	---	3.74	---	1.25
Cow-dung (kg/ha)	495.98	971.97	1824.75	1097.5	505.23	187.69	1567.08	753.33

Table 7. Pattern of labour and input use for the cultivation of groundnut in sampled area

Labour and Inputs used	Mymensingh	
	Local Variety	HYV
Human labour (m-d/ha)	102	140
Hired labour (m-d/ha)	59	71
Family labour (m-d/ha)	43	69
Seed (kg/ha)	124.75	110.61
Urea (kg/ha)	1.74	19.31
TSP (kg/ha)	17.48	109.70
MP (kg/ha)	11.39	42.14
Gypsum (kg/ha)	31.73	245.5
Borax (kg/ha)	0.37	5.45

used were 178.11, 138.03, 70.58 and 118.46 kg, respectively for HYV mustard and 146.95, 81.96, 45.09 and 46.46 kg for local variety. Per hectare fertilizers(urea, TSP, MP and gypsum) used were 19.31, 109.70, 42.14 and 245.5 kg for HYV groundnut and it was 1.74, 17.48, 11.39 and 31.73 kg for local variety, respectively.

Cost of Production

The cost of production included all variable cost items like human labour, animal power, power tiller, seed, manures, fertilizers, insecticides, irrigation etc. Both cash expenditure and imputed value of family owned inputs have been included. In case of family supplied inputs, opportunity cost was considered. On an average per hectare cost of HYV mustard was Tk. 34060 and local variety was Tk. 28181 whereas Tk. 57749 and Tk. 43062 for local variety of groundnut (Table 8 & 9). The cost of production was higher in groundnut cultivation compared to mustard due to higher labour and seed cost.

Table 8. Per hectare cost and return of mustard cultivation in the study areas

Items	Locations							
	Local Variety				HYV			
	Rajshahi	Pabna	Sirajganj	All	Rajshahi	Pabna	Sirajganj	All
A. Variable Cost (VC)								
Hired labour	6768	5695	6324	6263	8680	7747	8020	8149
Seed	463	493	560	505	510	514	555	526
Urea	831	1065	1199	1032	1154	1037	1420	1204
TSP	854	2425	3067	2116	3510	2975	4150	3545
MP	802	1367	1327	1165	1497	1825	2066	1796
Zipsum	78	450	297	275	474	118	689	427
ZnO	--	50	--	17	--	291	--	97
DAP	1316	--	1864	1060	142	--	--	47
Borax	216	89	373	226	748	377	573	566
Cowdung	496	972	1825	1098	505	188	1567	753
Ploughing cost	2453	2312	2389	2385	2382	2321	2457	2387
Insect/Pesticide	234	172	33	146	743	775	561	693
Irrigation cost	395	138	80	205	446	763	654	621
Transportation	1932	1119	1836	1629	3115	807	2784	2235
Int. on opp. capital	337	327	423	362	478	395	510	461
TVC	17174	16675	21596	18482	24384	20132	26007	23508
B. Fixed Cost (FC)								
Family labour	3581	4014	2866	3487	4260	5330	3606	4399
Rental value of land	5464	8233	4940	6212	5439	7998	5023	6153
TTC	9045	12247	7806	9699	9699	13329	8629	10552
C. Total Cost (A+B)								
Yield (kg/ha)	794	762	770	775	1323	1197	1220	1247
Return from mustard	34743	35695	34736	35058	61171	56363	61146	59560
Return from straw	2087	1991	2035	2037	2345	2377	2221	2314
D. Total return								
Net return	36829	37686	36771	37095	63515	58739	63367	61874
Over VC								
Over VC	19655	21011	15175	18613	39131	38607	37360	38366
Over TC	10610	8764	7369	8914	29432	25279	28731	27814
Benefit cost ratio:								
Over VC	2.14	2.26	1.70	2.01	2.60	2.92	2.44	2.63
Over TC	1.40	1.30	1.25	1.32	1.86	1.76	1.83	1.82

Profitability of mustard and groundnut production

The average yield was 1247 kg/ha for HYV mustard and 775 kg/ha for local variety of mustard. In this study, gross returns were Tk. 61874/ha and Tk 37095/ha for HYV and local variety of mustard, respectively. The farmer received Tk. 27814/ha and Tk 8914/ha as net returns for HYV and local variety of mustard. The benefit cost ratios (BCR) from HYV mustard

was calculated as 1.82 on total cost basis implying that one taka investment in HYV mustard return would generate Tk. 1.82 (Table 8).

The average yield was 2238 and 1540 kg/ha for HYV and local variety of groundnut, respectively. The gross returns were Tk 79384/ha and Tk 53178/ha for HYV and local variety of groundnut whereas farmers received Tk 21635/ha and Tk 10116/ha as net return. The benefit cost ratios (BCR) from HYV groundnut was calculated as 1.37 on total cost basis implying that one taka investment in HYV groundnut return would generate Tk 1.37 (Table 9). Benefit cost ratio in all the cases were higher than one. So, both the crops appeared to be economically profitable.

Table 9. Per hectare cost and return of groundnut cultivation in the study area

Items	Mymensingh	
	Local Variety	HYV
A. Variable Cost (VC)		
Hired human labour	7564.92	10567.11
Seed	17235.68	17033.57
Urea	12.00	144.61
TSP	519.38	2713.02
MP	332.41	1219.43
Gypsum	195.28	1512.54
Borax	47.51	678.73
Ploughing cost	2389.59	2642.15
Insecticide/Pesticide	---	990.99
Transportation cost	543.78	1101.77
Interest on operating capital	1153.62	1544.16
Total Variable Cost (TVC)	29994.17	40148.08
B. Fixed Cost (FC)		
Opportunity cost of family labour	5459.63	10238.82
Rental value of land	7607.06	7360.60
Total Fixed Cost	13066.69	17599.42
C. Total Cost (A+B)	43060.86	57747.5
Nut yield (kg)	1540.16	2237.52
Gross return (Tk./ha)	53178.34	79375.32
Net return (Tk/ha)		
Over variable cost	23184.17	39227.24
Over total cost	10117.48	21627.82
Benefit cost ratio		
Over variable cost	1.77	1.98
Over total cost	1.23	1.37

A. Variable cost included all input cost except cost of family labour

B. Fixed cost included opportunity cost of family labour and land cost

Input output relationship

Estimated values of coefficient and related statistics of Cobb-Douglas production function of mustard and groundnut are presented in Table 10 and Table 11. The result showed that most of the coefficients had positive sign. The coefficient of human labour (X_1) was found positive and significant in both varieties of mustard and groundnut at 1 % level of significance. It indicates that 1 % increase human labour for better practice and management with other factors remaining constant would increase the production of HYV mustard, local variety of mustard and groundnut by 0.39, 0.44 and 0.446, respectively. The coefficient of TSP(X_5) also found to be positive and significant in all cases. Coefficient of ploughing cost(X_2) is found positive and

significant for local variety of mustard and groundnut while it was negative for HYV mustard. The coefficient of seed (X_3) and gypsum(X_7) for local variety of mustard and coefficient of MP (X_6) for groundnut were found negative and significant which indicate inefficient use of these inputs for crop production. The coefficient of multiple determinations (R^2) was found 0.69, 0.61 and 0.84 for HYV mustard, local variety of mustard and groundnut, respectively implying that the explanatory variables included in the model explained 69%, 61% and 84 % of the variation in return from these crops production. The F-value of all the equation were found significant at 1% level indicating that the variation in return from these crops mainly depends upon the explanatory variables included in the models.

Table 10. Estimated values of coefficients and related statistics of Cobb-Douglas Production function model for mustard

Explanatory variable	HYV		Local	
	Coefficient	t-values	Coefficient	t-value
Intercept	6.929	5.224	-0.886	-0.419
Human labour (X_1)	0.399*** (0.103)	3.882	0.435*** (0.147)	2.950
Ploughing cost (X_2)	-0.561*** (0.185)	-3.034	0.744*** (0.270)	2.756
Seed (X_3)	0.244 (0.189)	1.291	-0.296* (0.160)	-1.846
Urea (X_4)	0.166* (0.086)	1.925	0.101 (0.100)	1.001
TSP (X_5)	0.235** (0.112)	2.092	0.004*** (0.015)	3.227
MP (X_6)	0.003 (0.073)	0.549	0.007 (0.016)	0.463
Gypsum (X_7)	0.003 (0.055)	0.637	-0.003*** (0.014)	-2.725
Irrigation and insecticide (X_8)	-0.002*** (0.005)		-0.0009 (0.009)	-1.093
R^2	0.689		0.606	
F	5.821***		6.147***	

Figures in the brackets are standard errors of the regression coefficient

***Significant at 1% level, ** Significant at 5% level, *Significant at 10% level

Table 11. Estimated values of coefficients and related statistics of Cobb-Douglas Production function model for groundnut

Explanatory variable	Coefficient	t-value
Intercept	1.772	0.803
Human labour (X_1)	0.446*** (0.142)	3.148
Ploughing cost (X_2)	0.266* (0.155)	1.719
Seed (X_3)	0.286 (0.281)	1.019
Urea (X_4)	-0.047 (0.049)	-0.968
TSP (X_5)	0.527** (0.250)	2.108
MP (X_6)	-0.703*** (0.194)	-3.619
Gypsum (X_7)	0.215* (0.123)	1.745
Borax (X_8)	0.003 (0.082)	0.373
R^2	0.836	
F	14.029***	

Figures in the brackets are standard errors of the regression coefficient

***Significant at 1% level, ** Significant at 5% level, *Significant at 10% level

Constraints of mustard and groundnut cultivation

The sample farmers encountered different constraints in cultivation of mustard and groundnut. The major constraints were found to be scarcity of fertilizer (96%), timely non-availability of good seed (78%), HYV seeds are not available in the market (70%), timely not available human labour (58%) and incidence of disease (25%). Farmers opined that they could not attain expected yield due to these constraints (Table 12).

Table 12. Constraints to mustard and groundnut cultivation

Constraints	Mustard			Groundnut	All areas
	Rajshahi	Pabna	Sirajganj	Mymensingh	
Scarcity of fertilizer	29 (96.57)	30 (100)	28 (93.24)	33 (94.28)	120 (96)
Timely non- availability of good seed	23 (76.59)	24 (79.92)	24 (79.92)	26 (74.24)	97 (77.6)
HYV seeds are not available in the market	21 (69.91)	21 (69.91)	19 (63.27)	26 (74.24)	87 (69.6)
Timely not available human labour	18 (59.94)	15 (49.95)	17 (56.61)	22 (62.86)	72 (57.6)
Incidence of disease	9 (29.97)	8 (26.64)	6 (20)	8 (22.85)	31 (24.8)

Note: Figures in the brackets indicate percentage

Conclusion and Recommendations

Based on the result it can be concluded that the average yield of HYV mustard and groundnut is higher than local variety. This crop is gaining popularity in the country very quickly due to its high yield potential. Optimum level of input use and timely by cultural operation is important for achieving higher yield and profits. Although HYV mustard and groundnut is a profitable crop but it is very cash cost crop thereby high cash involvement may restrict mustard and groundnut area expansion. A good opinion came out from the sample farmers that higher yield and income encourage them for continuing mustard and groundnut cultivation. They also revealed that most of the coefficient had significant impact on the yield of mustard and groundnut. To increase the production, information like proper sowing time, seed rate, fertilizer dose needs to be provided to the farmers and strong extension programme and proper monitoring by the field staff need to ensure to increase area under mustard and groundnut production. Credit should be supplied to the poor farmers with low interest and easy terms. It is extremely needed to increase the total production of oilcrops by fitting the oilcrops in existing cropping patterns, replacing the low yielding varieties by HYVs, improving management practices by motivating farmers through training, demonstration trials and publicities.

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